Remarks

Claims 1-26 are pending in the application. Claims 1, 2, 4-12, 14, 15, 17-20, 22, 23 and 26 are rejected. Claims 3, 13, 16, 21, 24 and 25 are objected to. All rejections and objections are respectfully traversed.

The invention determines correspondence between locations on a display surface having an arbitrary shape, and pixels in an output image of a projector, to be displayed on the display surface. A set of known calibration patterns is projected onto the display surface. An intensity of light is sensed directly at each of a plurality of locations on the display surface for each calibration pattern, there being one discrete optical sensor associated with each location. The intensities at the locations are correlated to determine correspondences between the plurality of locations and pixels in the output image of the projector.

Claims 1, 2, 4-11, 14, 15, 17-20, 22, 23 and 26 are rejected under 35 U.S.C. 102(e) as being anticipated by Surati et al. (U.S. Patent 6,456,339).

Surati describes a method for correcting imperfections in the alignment of optical system and fabrication of very high-resolution display devices. Surati measures a relative alignment, rotation, optical distortion, and intensity gradients of an aggregated set of image display devices using a low cost reference. It should be understood that Surati indirectly acquires an image of a projected image using a camera aimed at a screen. In other words, Surati only measures a reflection of the projected image. The camera is then

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calibrated with the projector projecting the projected image. Surati never measures light intensity produced directly by the projector. Further, Surati maps camera pixels to projector pixels, which has nothing to do with what is claimed. Claimed is directly measuring the intensities of projected calibration images, and correlating the intensities to output images.

Regarding claims 1, 23 and 26, a set of known calibration patterns is projected onto display surface having an arbitrary shape. The invention senses *directly* an intensity of light at each of a plurality of locations on the display surface for each calibration pattern, there being one discrete optical sensor associated with each location. The first clear distinction between Surati and what is claimed is that Surati senses light indirectly, see col. 8, lines 47-54, below:

> In a preferred embodiment, a camera **17** monitors the
> screen **11** during a calibration phase, or during frames stolen
> 50 from a moving display. A picture of the screen **11** taken by
> the camera **17** is fed back to a computer **18** which also
> controls the projectors P_1-P_4. The computer **18** first cali-
> brates the camera **17** with reference to the screen **11**, and
> then establishes a screen to projector mapping, which is used
> 55 to distort images before they are sent to the projectors. These

Surati describes a camera directed at a screen to *indirectly* sense projected light. The projected light must reflect off of the screen before the camera can sense the light. Thus, the Surati method is sensitive to the reflective properties of the screen. The invention directly senses an intensity of light using a discrete optical sensor associated with each location on the display surface. Therefore, according to the invention, light is projected directly onto the discrete sensors at the plurality of locations on the display surface.

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Further, claimed is correlating the intensities at the locations to determine correspondences between the plurality of locations and pixels in an output image of the projector. Surati *"first calibrates the camera 17 with reference to the screen 11, and then establishes a screen to projector mapping,"* see above. Surati must calibrate the camera to the screen before establishing a screen to projector mapping. The invention determines projector to display area correspondences directly. Therefore, Surati can never anticipate what is claimed.

In claim 2, each location has known coordinates. Surati indirectly senses light reflected from a screen using a camera to acquire the screen. Claimed is a plurality of locations on the display surface having one discrete optical sensor associated with each location. Intensity of light is sensed directly at each location. Surati never describes any of this. The Examiner's reference to col. 15 has nothing to do with determining correspondences between a display surface and projector. The section at col. 15 describes image warping that takes place after Surati determines mappings between the camera, projector and screen.

In claim 4, the correspondences are used to determine parameters of the projector. In claim 5, the parameters include internal and external parameters and non-linear distortions of the projector. As stated above, Surati never determines correspondences as claimed. Surati must determine camera-projector-screen mappings using indirect light measurements to determine projector parameters. The invention can directly determine projector-display correspondences by directly sensing light intensity at the locations.

Claim 6 recites warping an input image to the projector according to the correspondences and projecting the warped input image on the display surface to appear undistorted. As stated above, Surati never determines correspondences between the plurality of locations having one discrete optical sensor directly sensing light intensity at the location and pixels in an output image of the projector.

In claim 7, the projector is casually aligned with the planar display surface. In claim 8, the display surface is planar. In claim 9, the display surface is quadric. In claim 10, a viewer and the projector are on a same side of the display surface. In claim 11, the display surface is planar and a number of locations is four. Surati never describes a display surface having a plurality of locations, there being one discrete optical sensor associated with each location. Therefore, Surati can never anticipate what is claimed.

In claim 14, the intensity is quantized to zero or one. As stated above, Surati senses light indirectly, after the light is reflected off a screen. Claimed is sensing directly an intensity of light at each of a plurality of locations on the display surface.

Claim 15 recites warping a sequence of input images to the projector according to the correspondences and projecting the warped sequence of input image on the display surface to appear undistorted as a video. Surati never determines correspondences between the plurality of locations having one discrete optical sensor directly sensing light intensity at the location and pixels in an output image of the projector, as claimed.

In claim 17, the display surface is an external surface of a 3D model of a real-world object. In claim 18, the display surface includes a backdrop on which the 3D model is placed. Surati never describes a display surface having a plurality of locations, there being one discrete optical sensor associated with each location. Therefore, Surati can never anticipate what is claimed.

In claim 19, the light is infrared. As stated above, Surati senses light indirectly, after the light is reflected off a screen. Claimed is sensing directly an intensity of light at each of a plurality of locations on the display surface.

In claim 20, the correspondences are used to relocate the projector. In claim 22, the correspondences are used to deform the display surface. Surati never determines correspondences between the plurality of locations having one discrete optical sensor directly sensing light intensity at the location and pixels in an output image of the projector, as claimed.

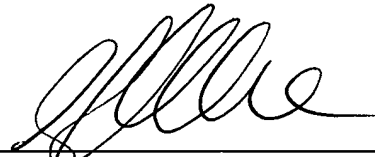Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over

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In claim 12, the optical sensor is a photo transistor. As stated above, Surati senses light indirectly with a camera, after the light is reflected off a screen. Claimed is sensing directly an intensity of light at each of a plurality of locations on the display surface. Surati can never be used to make the invention obvious.

It is believed that this application is now in condition for allowance. A notice to this effect is respectfully requested. Should further questions arise concerning this application, the Examiner is invited to call Applicant's attorney at the number listed below. Please charge any shortage in fees due in connection with the filing of this paper to Deposit Account 50-0749.

Respectfully submitted,
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